



Multifactorial Analysis of Natural Decay Durability of Wood

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Thematic action concerned: WP3

Context —

LERMAB and IAM collaborate since long time on wood durability and especially on mechanisms developed by fungi to degrade lignocellulosic polymers of wood. Special attention has been paid to the effect of extractives on the durability of numerous wood species from temperate and tropical area, as well as on the effect of extractives on glutathione transferases (GSTs) isolated from different decaying fungi involved in cellular detoxification processes. The aim of the research proposal will be to develop a methodology to access wood decay durability performances based on different intrinsic characteristics of wood. Such a methodology can find direct applications to improve wood uses and competitiveness compared to other building materials allowing therefore carbon storage in the material limiting effects of global warming.

Objectives —

The specific objectives are to acquire better knowledge of the reasons of wood natural durability to decay by identifying wood specific characteristics or combinations of specific characteristics, which may correlate with wood durability. It is especially expected to clarify the role of extractives according to their intrinsic properties like antimicrobial, fungicidal, antioxidant, hydrophobic properties, but also to better understand water regulation effect in connection with wood vapor sorption and water uptake directly related to wood anatomy. Wood chemistry and wood density will be also investigated in relation with durability.

Approaches —

A sampling has been carried out on different tropical and temperate wood species, around twenty species all together, including naturally durable and non-durable wood species. For each species, different characteristics have been measured in parallel to their decay durability evaluated with different white rot and brown rot fungi using mini-blocks procedure. These different measurements permit to characterize wood properties to highlight effect of physical (P), chemical (C) and anatomical (A) properties on wood durability. From the obtained data, using classical statistical analysis (PCA, PERMANOVA, CAH,..), the main factors involved in the wood durability have been identified.

Key results —

- Relation between wood and water presents and important effect on wood durability
- Activity of extractives towards GST rather than extractive contents appears also to be a key parameter to explain durability
- Finally, wood chemical composition and especially sugars / lignin ratio appears also as a key parameter

Main conclusions including key points of discussion —

Wood durability is not explicated by the sole presence of high amounts of extractives as generally reported in the literature. The best model to explain wood durability based on the sum of the percentage of degradation measured for the 3 white rot and the 3 brown rot fungi investigated involves contact angle, water uptake after immersion in water, wood density, the ration between polysaccharides and lignin measured by Py-GC-MS and general activity of extractives on glutathione transferases (GSTs).

Perspectives —

The work carried out in this study has been developed on a limited amount of wood species and it will be interesting to increase the amount of wood species studied. International collaborations, between France and African countries like Gabon, Cameroun, Kenya or Ivory Coast could be involved latter as well as collaborations with Asian countries, like Indonesia or Malaysia. French Guyana in South America could be also involved in the potential continuation of this project.

Valorization —

A publication on the results of the study is in preparation for International Biodegradation & Biodeterioration or Microbial Biotechnology.

Leveraging effect of the project—

The results obtained will make it possible to initiate future collaborations with various partners interested in wood natural durability.